BATS

Nature's Misunderstood Night...

by Tom Fitzmaurice

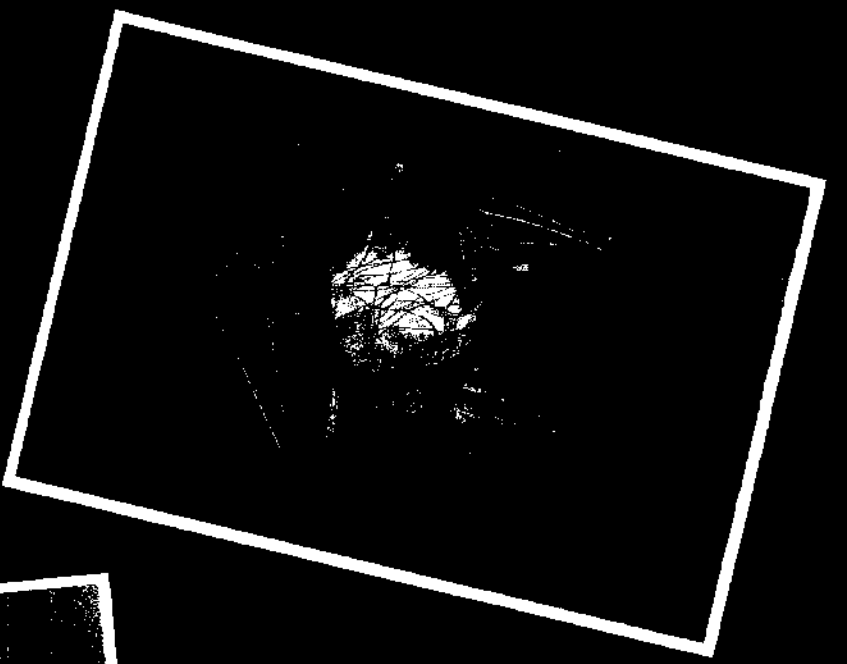
Feared and distrusted, bats are the victims of a bad reputation. Dark and silent to the human ear, these winged creatures of the night evoke images of dracula-like vampires and evil spirits. Like wolves, owls and other wildlife commonly heard or seen in the night, they are suspected of evil acts.

To dispense with a few of the most common misconceptions concerning bats, you will be relieved to know they do *not* become entangled in your hair and they are*not* dirty or mostly rabid. In fact, bats are quite fastidious and their association with rabies has been extremely exaggerated. The few bats which do contract the disease are rarely aggressive and in most cases die quickly. According to the U.S. Fish and Wildlife Service (USFWS) and Bat Conservation International, Inc. (BCI), an organization dedicated to the conservation of bats,*less than one-half of one percent of all bats contract rabies* and far fewer than that ever pass the disease on to humans. "More people are killed by lightning or lawnmowers," notes Dr. Merlin D. Tuttle, president of BCI.

Probably the most vivid misconception concerning bats is the fear that they are vampires, feeding on blood of living mammals. Over 950 species of bats occur world-wide, but only three are vampires. These three species are*not* found in the United States. They reside in the tropics of Central & South America where they frequently feed on cattle and other livestock, rarely humans. Fifteen species of bats, none vampires, occur here in Washington.

In reality, the most harmful characteristic common to bats as a whole is their poor public image. While superstitions surrounding them are well-known, the facts often come as a surprise. For instance, in the tropics, tremendous numbers of bats feed on nectar and fruit and provide the vital service of seed dispersal and pollination. Peaches, avocados, bananas, figs, dates and cashews represent just a few of these bat-dependent wild plants.

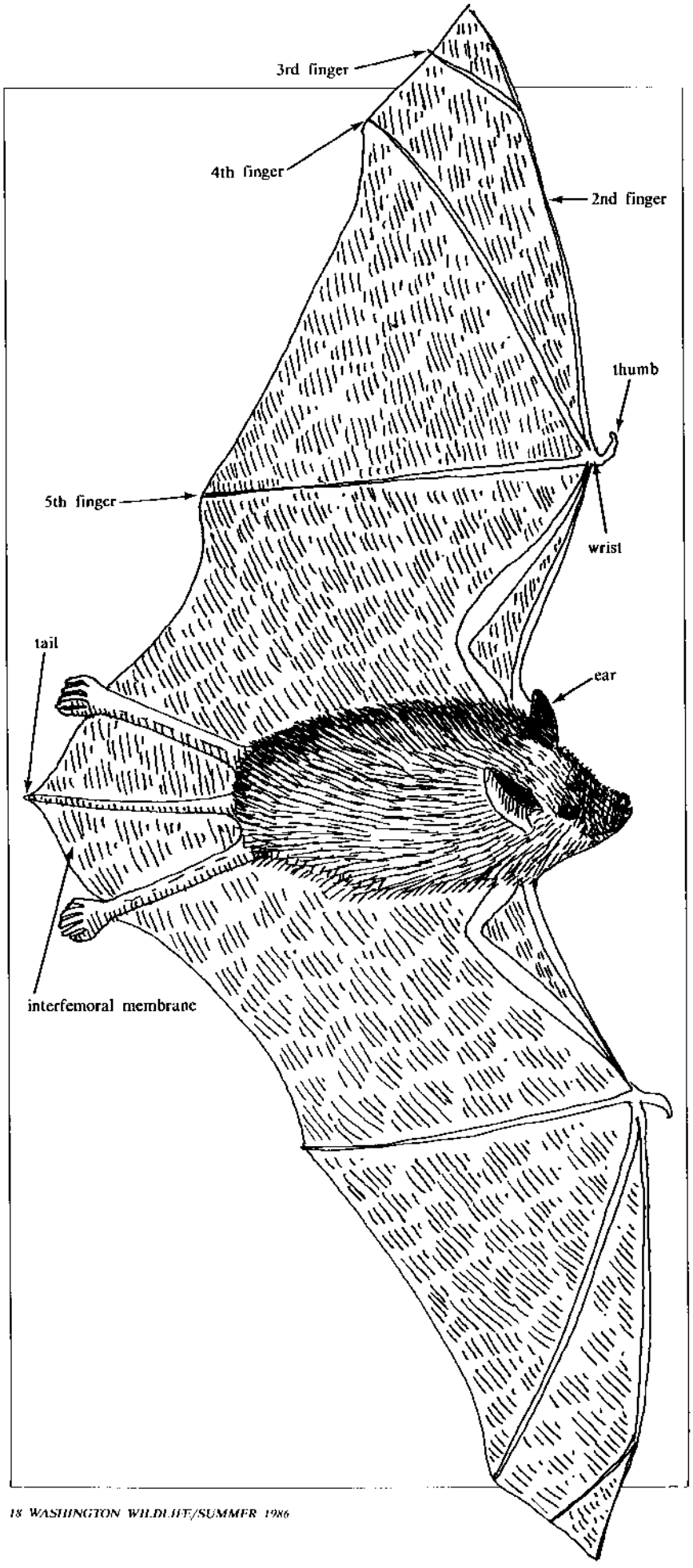
In the United States where bats feed exclusively on insects, the USFWS & BCI report that a single gray bat can consume up to 3,000 insects per night and that a Texas colony of free-tailed bats numbering 20 million individuals eats up to a quarter of a million pounds of insects every night. Similarly, reports indicate the little brown bat, common in Washington, can devour over 140 mosquitos in less than 15 minutes and up to 900 insects within an hour! Obviously, bats make a significant contribution to the control of insects!



(left) Pallid bat, unique for its habit of catching scorpions, unharmed by their stings.

(both photos above) Townsend's big-eared bats perched and harmlessly caught in a mist net for study and release.

Photos left and above by Merlin D. Tuttle, Bat Conservation International. Top photo by Doug Wechsler.



MAYA SPIER

Fingers For Flight

Bats are mammals, not birds. Comprising the order *Chiroptera*, world-wide they represent the second largest order of mammals, outnumbered only by rodents and are the only mammals capable of true flight.

Chiroptera literally translates to "hand-wing," reflecting their most unique morphological adaptation. The wing of a bat is actually a modified hand with greatly elongated fingers. Spread between the fingers is a double layer of elastic skin. This membrane encloses the fore limbs, hind limbs and, in some species, the tail. Bats are skillful flyers capable of quick, precise turns and complex maneuvers, a necessity if they are to be successful in the pursuit and capture of flying insects. The wing is also used as an aid in capturing insects, using the tip and membranes to encompass the prey during flight like a basket or net.

In addition to a hand modified for flight, bats also have unusual legs. They are attached at the hip "backwards." When bent, the knee points backward and the bottom of the foot faces forward! It is thought that this adaptation aids bats in their unusual habit of alighting upside down and hanging by their toes!

"Ears That See"

Many people believe bats are blind. Not so. While visual acuity varies with each species, bats see quite well, although like many species of wildlife, they cannot detect color. The ability of bats to move about in total darkness long piqued the curiosity of scientists, but it took many years of research to discover the truth and even longer for the truth to be accepted.

As early as the 1700's, an Italian scientist, Lazairo Spallanzani, began a series of simple experiments to determine how bats oriented themselves in total darkness. He discovered that bats lost their ability to orient themselves when sacks were placed over their heads. Later refinements in these initial experiments determined that bats were also incapable of avoiding objects when only their ears were plugged! These results stymied researchers for years and it was not until the 1930's that Dr. Donald R. Griffin employed the use of mi-

crophones sensitive to ultrasonic sound and discovered that bats use echoes of their calls to locate obstacles, a technique known as *echolocation*. In their natural habitat, echolocation is primarily used for locating and capturing prey.

The human ear can detect sounds up to 20,000 cycles per second. While hunting, bats emit a continuous array of chirps ranging from 25,000 to 75,000 cycles or vibrations per second. According to Ben Patrusky in the *1986 World Book Science Annual*,, bats searching for prey will emit a predominantly single-toned frequency called constant frequency (CF). This is emitted at a fairly constant rate which varies from species to species. When a prey item is detected, the distance to the target is determined by the amount of time which elapsed between the sound emission and the return of the echo.

Once an insect is initially detected, many bats then alter both the type and rate of their call and shift to frequency modulated or (FM) sonar. In contrast to CF sonar, FM sonar consists of many tones which sweep through a number of frequencies. This allows the bat to gather detailed information on the prey at hand such as size, shape and even texture plus additional information on the speed of the prey. As Patrusky reports, "a bat using FM signals can determine just about everything but the color of its target."

On approaching prey, bats dramatically increase the rate of their signals, often up to 200 or 300 signals per second. This almost continuous emission is called a "feeding buzz." Imagine the intensity and variety of sounds one might hear if our ears could detect the calls emitted by bats foraging overhead on warm summer nights!

Surviving Winter

While the summer skies abound with insects and foraging bats, winter nights mark the absence of both. It is thought that some solitary species like the silvery-haired bat, which roosts during the day under tree bark, may migrate to warmer climates. Other species hibernate. Bats which remain in the Northwest throughout the year must select a winter roosting site during the fall. Caves, mines and abandoned buildings often provide undisturbed sites for winter shelters called "hibernacula" in which many bats may hibernate clustered or spread about the enclosure.

Bats select dark sites which have low, but not sub-freezing, temperatures. While hibernating, they must maintain a delicate balance of temperature regulation. Body temperature drops to within a few tenths of a degree of the surrounding environmental temperature. Heart rate, blood flow and rate of breathing are significantly slowed, to conserve energy. If the temperature in the roost becomes too cold, an energy-consuming shivering reaction is triggered to keep the bat from freezing.

Bats are gentle and beneficial mammals, not known to bite except in self defense. Leave them alone and they are happy to return the favor.

Hibernating bats must maintain a strict energy budget if they are to survive. Each time a bat is aroused, due to a severe drop in temperature or human disturbance, 10 to 30 days of stored energy is wasted! Huge colonies of bats have been needlessly destroyed by careless disturbance at hibernation sites.

The Nursery

Late summer and fall is a period of intense activity for bats. Just prior to migration or hibernation bats continue to feed, increasing the levels of body fat to tide them through southerly journeys or periods of hibernation. Mating also takes place in the fall. While the females are typically inseminated in the fall or winter, ovulation does not occur until spring and it is not until this time that the eggs are fertilized!

While echolocation, hibernation and delayed fertilization all illustrate the sophisticated and complex physiological aspects of bats, nursery colonies provide us a glimpse of their intriguing social behavior. During the period prior to birth and until the young are weaned, females of colonial species gather together in clusters or nursery colonies. Like hibernacula, nurseries are commonly quiet, dark sheltered areas. Females select sites with high, domed ceilings such as caves or abandoned buildings which trap heat. Species such as the little brown bat are just as likely to select the attic space of a home, often entering in small openings under loose shingles or vents. During this time males will roost elsewhere.

The young are typically born from May through July. During birth, the females of several species hang head up rather than upside down and the young is received in the pocket of the interfemeral membrane which stretches between the tail and hind legs! Most females give birth to a single young but some species such as the silver haired bat do have twins and even fewer species, triplets. The young bat immediately crawls up the mother's belly and attaches itself to a nipple. In some instances the young may be carried along while the females feed. More commonly, they are left behind, huddled together for warmth in the dark nursery site, and the females return periodically throughout the night to nurse. Although individuals in a tightly clustered mass of young bats might look all alike to an outside observer, females seem to have no problem locating their own young among the many hungry mouths.

Bats in Today's World

Despite aggressive campaigns to educate the public with facts, the myths persevere. Bats continue to be needlessly and at times maliciously killed. Huge colonies of bats numbering in the thousands, dwelling in their natural habitats such as caves, have been decimated with fire, explosives and poisons. Small, harmless colonies near human habitation are often exterminated by uninformed individuals fearing rabies.

In addition to their crucial role in sustaining tropical rain forests and associated crops and insect control, bats have many characteristics which make them equally important in the field of medical and scientific research. Long-lived with the ability for delayed fertilization, echolocation and hibernation, they are a priceless resource to scientists. Studies of bats have contributed to resolving fertility problems including the process of artificial insemination. The use of bats in navigational and accoustical studies continues to open new horizons in developing aids to the blind as well as in sonar used in military defense. Bats also are used in studies on aging, healing processes, vaccinations and speech pathology.

Like many wildlife species, bats were severely impacted by the use of DDT. Populations of several species plummeted as they ingested pesticide contaminated insects. Despite the continued ban of DDT in the United States, most affected populations of bats have never recovered to pre-DDT population levels. Unfortunately, other toxic chemicals including pesticides, insecticides and herbicides continue to contaminate and depress this irreplaceable wildlife resource.

There are currently four species of bats which are officially recognized as federally endangered. Included on this list are the gray bat and the Ozark and Virginia big-eared bats. The total population of the gray bat can be located in only a few select cave sites during hibernation or, in the case of the big-eared bats, in year-round roosting caves. This makes them extremely vulnerable to disturbance and vandalism. These careless and destructive activities have decimated 80 percent of a once-healthy population of gray bats. Vandalism and careless disturbance have also impacted the Indiana bat, also endangered with extinction. Habitat loss and pollution near their preferred feeding sites have further contributed to their decline.

In recent years, bat researchers in Washington have noted a decline in the state's population of the Townsend's big-eared bat, a close relative to the already endangered eastern big-eared bats. In a study conducted in 1985 by Dr. Clyde Senger and sponsored by the USFS, Gifford Pinchot National Forest, historical and potential habitat for this species was explored on a portion of the forest. Few caves were found to be adequate for hibernating bats and it was not until 1985 that a nursery colony within the study area was located.

To further assess the status of the species, the WDG and Gifford Pinchot National Forest cooperated on a second research project to investigate other historically known concentrations of the big-eared bat in southwestern Washington. According to bat researcher Mark Perkins, who conducted the field studies, the Townsend's bat is a cave-dwelling species. "During the winter, they use only a few, select caves which must meet their temperature and humidity requirements to survive the winter," he reports. "In the summer, females cluster together to form nursery colonies and are very intolerant of disturbance." Out of a total of 82 caves explored during both the winter and summer months, only 20 caves were found to harbor hibernating bats and a single nursery colony consisting of about 250 females was located. Says Perkins, "comparing these levels to those previously documented, it appears that the population under study has declined perhaps by as much as 50% during the last 15 years." Again, human disturbance ranging from incidental to repeated entry by caving enthusiasts and researchers alike may have contributed to the population decline.

The Townsend's big-eared bat is now proposed to be added to the list of threatened species in Washington.

Bat Conservation International

Bat Conservation International (BCI) was founded to meet urgent increasing conservation demands that require funding. The purpose of BCI is to prevent extinction of bat species, to ensure survival of viable bat populations, and to inform the public of the value of bats.

The organization's logo is from an ancient Chinese design. Five stylized bats are joined in a circle to symbolize the five blessings—health, long life, prosperity, love of virtue and natural death—and surround the prosperity symbol.

The president and founder of BCI, Dr. Merlin D. Tuttle, who was kind enough to contribute photos and expertise to the accompanying article, is an internationally recognized authority on bat biology. He has studied bats for more than 20 years and is a leader in the field of bat conservation. His work has been featured worldwide in numerous magazines and scientific journals.

Recommended reading includes Tuttle's fascinating article, "Gentle Fliers of the African Night," accompanied by his own superb photographs, which appeared in the April 1986 *National Geographic* magazine.

BCI memberships ($15 student/senior, $25 regular, $50 supporting, $100 contributing and $500 life member) help fund bat research and conservation programs. Members receive the quarterly international newsletter and discounts on educational programs. All contributions are tax deductible.

Bat houses are also available from BCI to attract bats to your area. Remember, bats love to dine on insects, including mosquitos! The red cedar bat houses are 17" tall, 10" wide and 7" deep, front to back, with dividers inside for roosts. They are open at the bottom so that you can observe these fascinating mammals.

Houses are $29.95 retail plus $2.75 shipping and handling. Proceeds benefit BCI.

Write Bat Conservation International, Inc., c/o Brackenridge Field Laboratory, University of Texas, Austin, Texas 78712.

Of Washington's 15 different species of bats, two others, the Pallid bat and the long-eared Myotis, are considered sensitive species. Restrictions on the use of dangerous pesticides such as DDT have lessened the impacts of only one potential threat to bat populations.

The fate of these mammals is now more than ever tied to maintaining undisturbed habitat and preventing unwarranted destruction of bats themselves. Man's fear and distrust of bats always have been the greatest threats to healthy populations of these fascinating animals. You can participate in conserving this valuable wildlife resource by simply recognizing and respecting the bat's place and value in the world of nature and appreciating their contributions to maintaining a healthy environment for us to enjoy.WW

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MERLIN D. TUTTLE, BAT CONSERVATION INTERNATIONAL

A big brown bat, one of the most common species, perched on a barn wall. Although some roost in hollow trees or beneath loose bark of trees, most now live in buildings. They are extremely beneficial insect-eaters.

Further reading: "House Bat Management," Resource Publication 143, U.S. Dept. of Interior, Fish & Wildlife Service, Aylesworth Hall, CSU, Fort Collins, Colorado 80523;

Just Bats, by Brock Fenton, Univ. of Toronto Press, Toronto, Canada;

The Lives of Bats, by Wilfried Schober, Arco Publishing Inc., New York.

Bats of America by Roger W. Barbour & Wayne H. Davis, University of Kentucky Press, Lexington, Kentucky.

LIN D. TUTTLE, BAT CONSERVATION INTERNATIONAL

BAT Encounters

The Do's and Don'ts

People and bats rarely meet. When this does occur, inappropriate reactions, often based on fear, can lead to a frightening and potentially harmful situation, for both you and the bat!

Bats and your home:

During summer days, bats seek out dark, warm sheltered areas to rest or day roost. Window shutters, attics, cracks in chimneys, siding and roofs often provide safe and harmless resting sites for individual bats. But, occasionally a bat may stray into the interior of your home. At this point it probably has only one thing in mind, getting out! Shut all doors leading off to other areas in your home and open windows or doors which lead outside. *Given an opportunity, most bats exit quickly.*

Little brown bats and big brown bats are also known to use warm attics or walls for nursery colonies. If the bats are creating a nuisance, such as odors or annoying sounds, the safest and most effective resolution is to exclude the bats from your home by blocking entrances. Poisons can be dangerous, expensive and temporary! Blocking entrances will permanently bat proof your home. The following steps are suggested:

At dusk, observe where the bats are entering and exiting. Vents, loose shingles, cracks in siding, separating joints are all likely candidates. Often entrances are stained around the edges on light colored walls. A little brown bat can squeeze through a hole 3/8" x 1", so this process may take some effort on your part.

Hang a large piece of bird net—the kind used on fruit trees—about three inches in front of the entrance, extending down a couple of feet. The bats will then exit safely, but on their return will not go back into the roost around the net. Using small mesh hardware cloth, caulking, weatherstripping, or other materials, seal off all the entry holes observed and any potential sites AFTER you confirm

all the bats have left the roost! Not all bats will necessarily leave a day roost to feed each night, so wait several days.

If you are observing bat use in the early part of summer through July, the females may have young which are left behind while they feed in the evening. Therefore it is best to wait until September or October before sealing off accesses to avoid trapping young bats inside. This would only result in more problems.

Bats may day roost or raise young in outbuildings such as storage sheds or barns. Before excluding them, first ask yourself if it is necessary. It is likely they've chosen a spot with little or no human activity. *Bats do not cause structural damage by chewing or shredding material.* A small cluster of roosting or reproducing local bats can devour hundreds of thousands of insects throughout the summer. It may be to your advantage to simply leave them undisturbed!

Incidental Observations:

While enjoying summer outdoor activities such as camping, hiking or fishing you may observe bats roosting in tree bark, foliage, under bridges or in crevices of all kinds. Give them the same respect due wildlife of any sort: DO NOT DISTURB! Simply appreciate their presence and let them be. Observing bats feeding over lakes and ponds can be both educational and enjoyable, and remember, *the more bats, the fewer the mosquitos!*

Individuals participating in certain activities such as spelunking need to be particularly conscientious about minimizing disturbance to bats. Remember, you are intruding into their habitat which is limited at best! Avoid visiting caves used as nursery sites from April through September. Hibernacula should not be visited in the winter months. If you inadvertently enter a cave during these critical periods and observe bats, please leave quickly and quietly. Alert other potential visitors to avoid these caves. Contact your local Game Department office and report your sighting, you may have discovered a previously unknown site.

Play It Safe:

Bats don't bite if you don't handle them. Bats should never be unnecessarily handled. DO NOT touch or in any way attempt to handle a bat which is grounded, appears ill or is acting strangely. All sick animals should be avoided and bats are not an exception! Use common sense and don't invite danger or harm. If handling is unavoidable, use leather gloves, netting, or other material to protect yourself and to avoid injury to the bat. Remember most animals will attempt to bite if frightened by being caught and handled.